



Apple IIe #9: Switch Input Changes

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This Technical Note describes three changes which have been made to the switch circuitry of Apple IIe revision C and later motherboards.

The latest Apple IIe logic board has some changes in its switch circuitry. Logic boards with part numbers 820-0087-C and later differ from earlier boards as follows:

- SW2 has been connected to the Shift keys on the keyboard by closing the X6 jumper.
- 12k ohm pullup resistors have been added to SW0 and SW1.
- A 0.1 microfarad capacitor to ground has been added to all three switch inputs: SW0 (PB0, Open-Apple, OAPL), SW1 (PB1, Option, Closed-Apple, CAPL), and SW2 (PB2).

Differences are illustrated in Figures 1 and 2.

The X6 jumper was closed to allow the Shift key to be read directly, facilitating the shift-click mouse selection feature in software products. Note that this change connects SW2 to +5V through a 1k ohm resistor, and when a shift key is depressed, SW2 is at ground potential.

The 12k ohm resistors were added to ensure that the self-diagnostic test would run when the keyboard is disconnected. The resistors have negligible influence when the keyboard is connected.

The capacitors were added to reduce radiated emissions. This reduction was required because of changes in the memory configuration. As a result of the addition, the functional bandwidth of the inputs has been reduced; however, the input requirements of the 74LS251 have not changed. This addition may cause improper operation with peripheral devices that rely on high push button repetition rates.

The minimum V(IH) to the 74LS251 remains 2.0V, but for improved noise margin, a minimum V(IH) of 2.4V is recommended. This requires a drive of about 6 ma to overcome the 470-ohm 5 percent resistor on SW0 and SW1.

The maximum $V_{(IL)}$ is 0.8V, and here again you should allow for some noise margin. The low level is ensured by the 470-ohm keyboard pulldown resistor alone, but additional current sink will speed up the transition time.

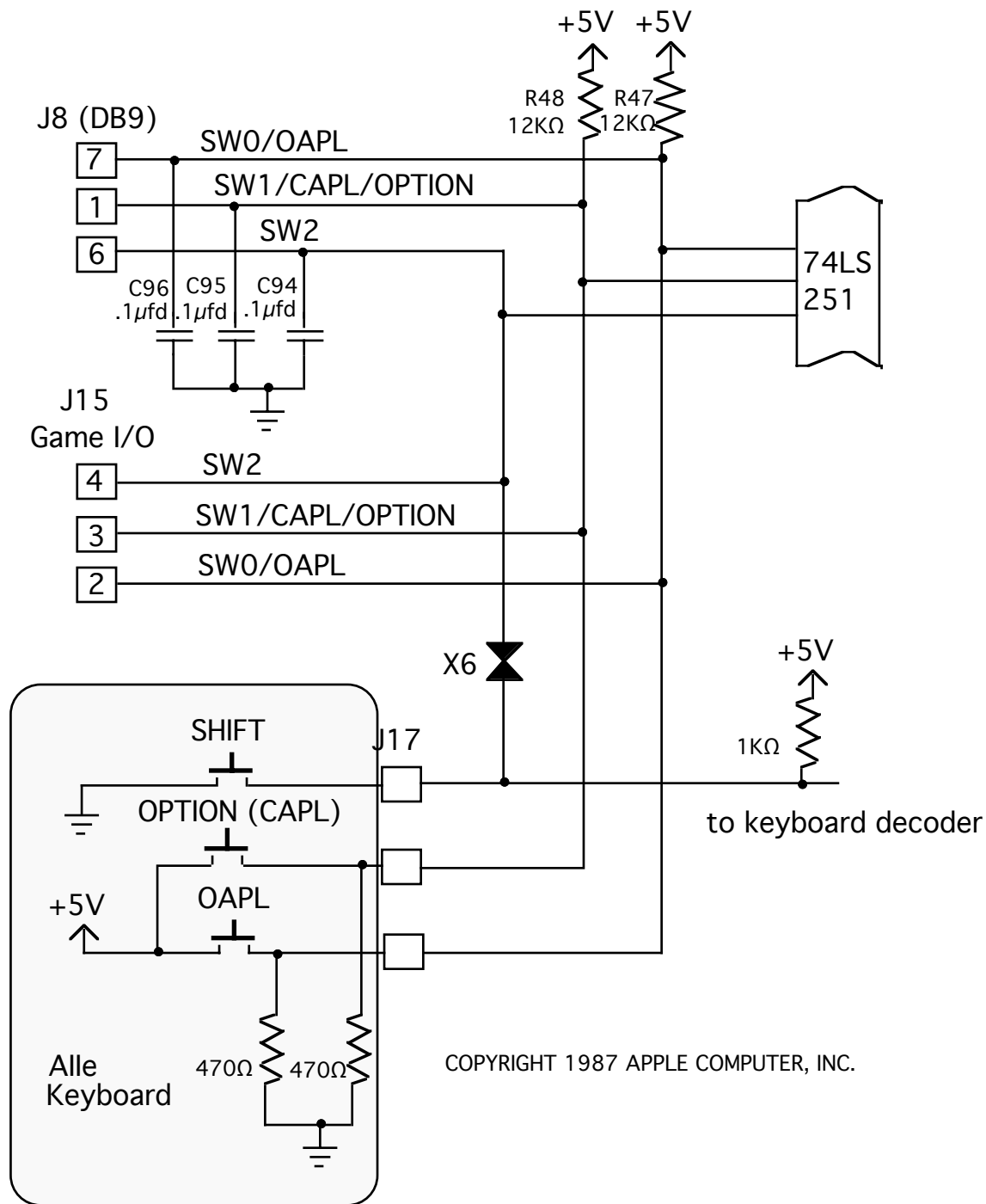
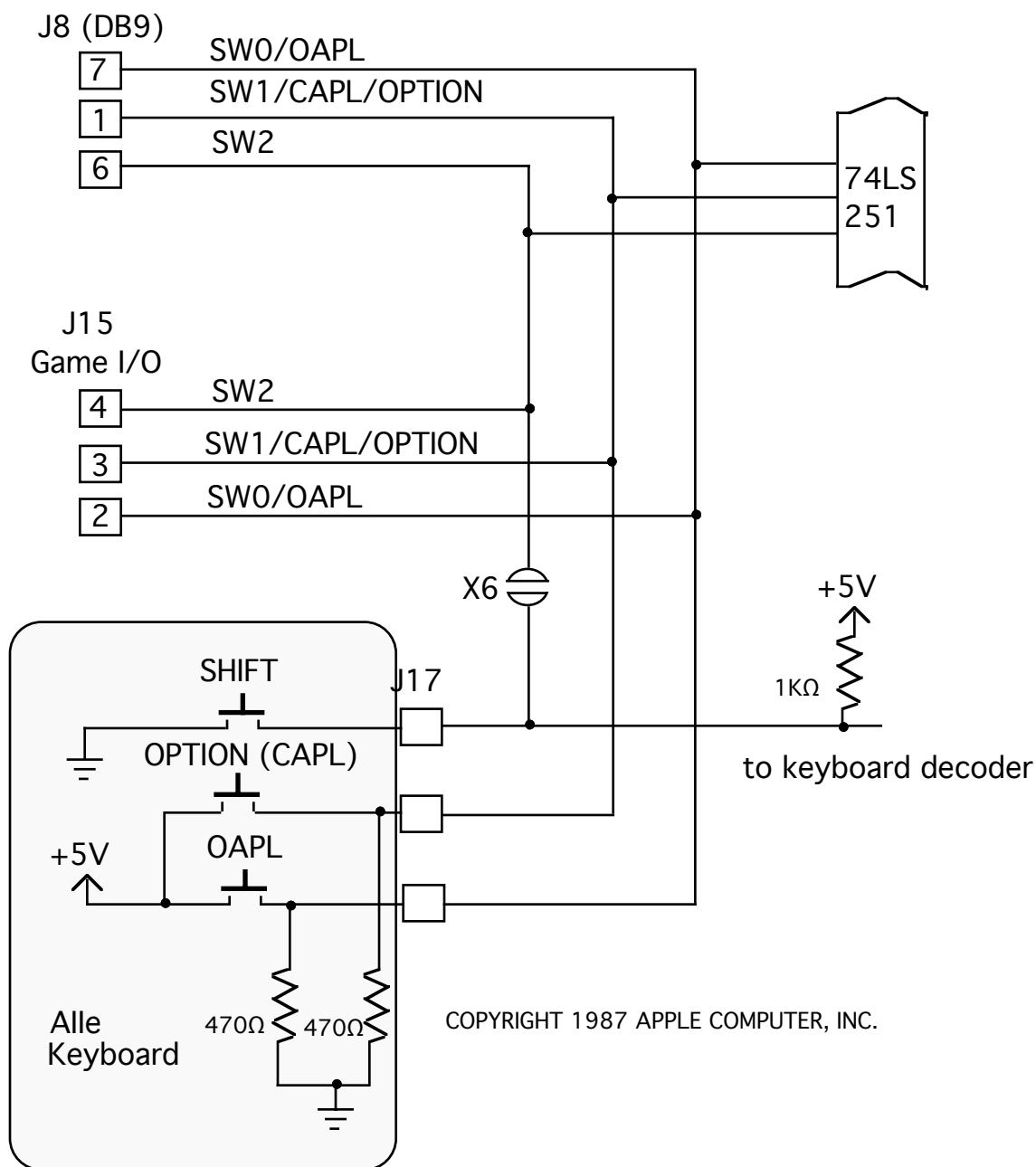


Figure 1—Circuit for SW0, SW1, and SW2 (aka PB0, PB1, and PB2)



**Figure 2—Circuit for SW0, SW1, and SW2 (aka PB0, PB1, and PB2)
Apple IIe 820-0064-B and 820-0087-A Logic Boards**

Further Reference

- *Apple IIe Technical Reference Manual*